Experimental Economics II

Legislative Bargaining

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This part is more theoretical since we are using formal theory to model political behavior.

Legislative Bargaining Model

How to divide one dollar? In ultimatum, the game ends after respondents reject. In Rubinstein bargaining, it goes to the next round. Legislative bargaining extends Rubinstein bargaining to more than two people.

- Rubinstein bargaining model requires unanimous consent to reach an agreement on the allocation. 2-person bargaining
- This rules out a number of important political settings where only a simple majority or a supermajority is required for agreement.
- Baron & Ferejohn (APSR 1989) have extended Rubinstein's model to simple majority rule with more than two bargainers.
- We suppose that there are N (odd number) players (bargainers) and any proposal requires $n = (N+1)/2$ votes. (Majority rule)
- Instead of assuming alternating offers, Baron & Ferejohn consider a bargaining protocol with a *random recognition rule*.
  - According to this protocol, in each period, every player is chosen to make a proposal with an equal prob. $1/N$.

Legislative Bargaining Model

- We first look at bargaining under a *closed rule* where the proposer makes a take-it-leave-it offer for the current legislative session.
- Later we consider open rule bargaining where proposals can be amended within the current session.
- The proposer in each period makes an offer $(x_1, x_2, ..., x_N)$ s.t. x_i is the share for player i; feasibility requires $\sum x_i \leq 1$.
  =1 to not waste resources
- If this proposal is rejected, the session ends, discounting occurs, and a new proposer is chosen at the beginning of the next session.
- To simplify, we assume that each player has the same discount factor δ. Classroom experiment: m=200, N=7, n=4, delta=0.5

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50-50-50-50- 0- 0- 0
50-50-50-50- 0- 0- 0
30-30-60-30-20-15-15
50-50-50-50- 0- 0- 0
20-30-30-30-30-30-30
20-20-20-20-20-80-20
 0- 0- 0-50-50-50-50
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50-50-50-50- 0- 0- 0 was chosen, and voted to acceptance at 4:3.

Stationary Equilibrium

- This game has lots of subgame perfect equ'a; in fact, for large N and δ, there is an SPNE that can support any division of the dollar.
- If the players are patient enough, they can design punishment strategies to guarantee \$0 to any defector.
- These strategies require, however, that each player know the whole (possibly infinite) history of the game in order to know which actions are consistent with the prescribed punishment.
- Thus, following Baron & Ferejohn, we analyze only *stationary* equ'a.
- A stationary equ'm to this game is one in which

(i) A proposer proposes the same division every time she is recognized (as a proposer) regardless of the history of the game.

(ii) Voters vote only on the basis of the current proposal and expectations about future proposals. Because of (i), further proposals have the same distribution of outcomes in each period.

Continuation Value

- The above two assumptions imply that the game essentially starts over in every period.
- Therefore, the continuation value of each player is the expected utility of the (entire) game.
- Let v_i be the continuation value for player i.
- We focus on symmetric equ'a so that $v_i = v$ for all i.
- Finally, we consider only equ'a in which voters do not choose weakly dominated strategies in the voting stages.
- Therefore, a voter accepts any proposal that provides her at least as much as the discounted continuation value.
- Therefore, any voter who gets $x_i \geq \delta v$ votes in favor of the proposal whereas any voter who receives less than δv votes against it.

Continuation Value

- Given these voting strategies, an optimal proposal gives δv to $n-1$ other players, $z = 1-(n-1)\delta v$ to the proposer, and 0 to the rest.
- We assume that the proposer chooses her coalition partners randomly.
- Since the continuation value v is just the expected value of the game starting next period, it is simply z times the prob. of being chosen as proposer $1/N$, δv times the prob. of being included in the winning coalition $(n-1)/N$, and 0 times the remaining prob.;

$$v = z \cdot \frac{1}{N} + \left(\delta v \cdot \frac{n-1}{N-1}\right) \cdot \frac{N-1}{N} + \frac{N-n}{N} \cdot 0 = v = \frac{z}{N} + \frac{n-1}{N}\delta v.$$

In classroom experiment

$$\delta v = 0.5 \times \frac{200}{7} = \frac{100}{7} = 14.2857\ldots$$

- Substituting for z and simplifying yields

$$v = \frac{1}{N}.$$

$$z = 200 - 3\delta v = 200 - \frac{300}{7} = \frac{1100}{7} = 157.14\ldots$$

- Thus, the continuation value is a proportional share of the dollar.
- Because v is also the expected utility of the game, this result implies that bargaining is efficient b/c the sum of player utilities is maximized.

Proposal Power

- Given our solution for v, the proposer's share is

$$z = 1 - \delta\frac{n-1}{N} = 1 - \delta\frac{N-1}{2N}.$$

- The proposer prefers to make an acceptable proposal since $z > \delta v$; otherwise the proposer would prefer to wait for the next period.
- One measure of proposal power is the difference

$$z - \delta v = 1 - \delta\frac{N+1}{2N}.$$

- First, proposal power increases in N.
  - When N increases, the proposer has more potential coalition partners to play off one another.
  - This increases the competition for inclusion in the winning coalition and drives down what the proposer must pay.
- Second, proposal power is decreasing in δ.
  - When δ is higher, the voters are more willing to vote down proposals and wait for a chance to propose themselves.
  - Thus, the proposer must be relatively more generous to secure agreement.

Supermajority Rule

- The model can be easily extended to capture situations where more than a simple majority is required for passage of the bill.
- Now assume that $k > n$ voters are required.
- The proposer's share is now

$$z = 1 - (k-1)\delta v$$

- The continuation values are now given by

$$v = \frac{z}{N} + \frac{k-1}{N}\delta v.$$

- Simple algebra gives that once again $v = 1/N$.
- This is b/c the supermajority rule preserves the symmetry of the majority rule game.
- The proposer's equ'm share is now lowered to

$$z = 1 - \delta\frac{k-1}{N}.$$

- Thus, the primary consequence of supermajority rules is to mitigate the proposer's advantage.

Asymmetric Proposal Power

- One limitation may be the assumption that all legislators have the same prob. of being recognized to make the proposal.
- In real world legislative institutions, membership in certain committees and parties may affect the prob. that an individual legislator gets to make a proposal.
- Suppose the members are divided into two parties A and B.
- Party A has $N - m \geq (N+1)/2$ members so that it is the majority party.
- Each member of A has a proposal power $p > 1/N$.
- Alternatively, there are m members of B who have proposal power $q < 1/N$.
- For consistency, we require that $(N - m)p + mq = 1$.

Asymmetric Proposal Power

- Again we assume symmetry so that every legislator with the same recognition prob. plays the same strategy and has the same continuation value.
- The members of the two parties have continuation values v_A and v_B, respectively.
- We conjecture for now (and prove later) that $v_A > v_B$.
- Given these continuation values, a member of party A votes for any proposal that provides her at least δv_A and a member of party B votes for a proposal giving her at least δv_B. Party B mmembers are easier to buy
- Given these strategies and the assumption that $v_A > v_B$, a proposer from party A gives δv_B to the m members of party B and δv_A to $n - m - 1$ members of party A (recall that $n = (N+1)/2$). Buy all party B members and (n - m) party A members.
- Thus, the proposer's share is

$$z_A = 1 - (n - m - 1)\delta v_A - m\delta v_B.$$

Asymmetric Proposal Power

- A member of B gives positive allocations to $m-1$ members of B and $n-m$ members of A so that the proposer's share is

$$z_B = 1 - (n-m)\delta v_A - (m-1)\delta v_B.$$

- Note that $z_A > z_B$.
- We can now compute v_A and v_B

$$\begin{aligned} v_A &= pz_A + p(n-m-1)\delta v_A + qm(n-m)\delta v_A/(N-m) \\ v_B &= qz_B + (1-q)\delta v_B. \end{aligned}$$

- Thus, we have four equations with four unknowns and solve this system for v_A and v_B.
- We simplify further by assuming $N=3$, $m=1$; and $q = 1-2p < 1/3$ (if $p > 1/3$).

Asymmetric Proposal Power

- With the above simplification, the equ'm conditions are the following:

$$
\begin{aligned}
z_A &= 1 - \delta v_B \qquad & v_A &= p z_A + q\delta v_A/2 \\
z_B &= 1 - \delta v_A \qquad & v_B &= q z_B + (1-q)\delta v_B
\end{aligned}
$$

- From this system, we find that

$$
\begin{aligned}
v_A &= \frac{(1-q)(1-\delta)}{2+q\delta-2\delta} \\
v_B &= \frac{q(2-\delta)}{2+q\delta-2\delta}.
\end{aligned}
$$

- We finally need to check our assumption that $v_A > v_B$, which occurs when

$$
q < \frac{1-\delta}{3-2\delta} < \frac{1}{3}, \text{ for } 0 < \delta < 1.
$$

Asymmetric Proposal Power

- Because this upper bound is always less than $1/3$ when $\delta > 0$, the asymmetry in proposal power must be substantial to give an advantage to party A.
- Party A's greater proposal power makes its members unattractive coalitional partners.
- Thus, the likelihood of being the proposer must be large enough to offset this effect.
- Finally, v_A is decreasing and v_B is increasing in q.

Asymmetric Proposal Power

- For completeness, we consider the case $(1-\delta)/(3-2\delta) \leq q < 1/3$.
- Suppose $v_B > v_A$; then B is never in a coalition with the proposer;

$$\begin{aligned} v_B &= qz_B = q(1-\delta v_A) \\ v_A &= pz_A + (1-p)\delta v_A = p(1-\delta v_A) + (1-p)\delta v_A. \end{aligned}$$

- This leads to

$$\begin{aligned} v_A &= \frac{1-q}{2(1-\delta q)} \text{ and} \\ v_B &= \frac{q(2-\delta-\delta q)}{2(1-\delta q)}. \end{aligned}$$

- Note that $v_B \geq v_A$ only if

$$q \geq \frac{(3-\delta) - \sqrt{(3-\delta)^2 - 4\delta}}{2\delta} \geq \frac{1}{3}$$

for $0 \leq \delta \leq 1$. But this is a contradiction!!

Asymmetric Proposal Power

Only for special case of N=3, m=2

- Hence, with $(1-\delta)/(3-2\delta) \leq q < 1/3$, the only possibility is $v_A = v_B$.
- To support this equilibrium proposers from A must choose a mixed strategy that randomizes b/w forming a coalition with the remaining member of A and forming one with the member of B.
- Let $(x, 1-x)$ be Party A member's mixing prob., as a proposer, so he chooses the other Party A member as his coalition partner with prob. x, and Party B member with prob. $1-x$.
- Then his proposer share $z_A = 1 - \delta v_A$ w/ prob. x and $z_A = 1 - \delta v_B$ w/ prob. $1-x$; and $z_B = 1 - \delta v_A$.
- This implies

$$
\begin{aligned}
v_A &= p[x(1-\delta v_A) + (1-x)(1-\delta v_B)] + px\delta v_A + \frac{q}{2}\delta v_A \\
v_B &= q(1-\delta v_A) + 2p(1-x)\delta v_B
\end{aligned}
$$

and with $v_A = v_B = v$, the above becomes a system of two equations in two unknowns v, x.

Asymmetric Veto Powers

- Some legislative institutions let certain players be privileged with the ability to block legislation such as the president, an upper chamber, or a court.
- Here, we try to incorporate vetoes into the Baron-Ferejohn model.
- Suppose that one member of our three-person legislature has absolute veto power in that she must approve every proposal.
- Let party B have the veto player.
- To keep matters simple, we return to the case of equal proposal powers ($p = 1/N$). $= \frac{1}{3}$ (for $N=3$)
- Because B has an absolute veto, any proposer must include B and at least one member of A in her coalition so that

$$z_A = 1 - \delta v_B \quad \text{and} \quad z_B = 1 - \delta v_A.$$

Asymmetric Veto Powers

- Computing the continuation values, we obtain

$$\begin{aligned} v_A &= \frac{1}{3} z_A + \frac{1}{3}\frac{1}{2}\delta v_A \\ v_B &= \frac{1}{3} z_B + \frac{2}{3}\delta v_B. \end{aligned}$$

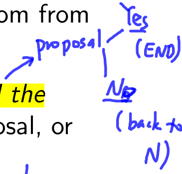
- Thus, we can solve for

$$\begin{aligned} v_A &= \frac{2(1-\delta)}{6-5\delta} \\ v_B &= \frac{2-\delta}{6-5\delta} \end{aligned}$$

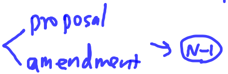
- Note that $v_A < v_B$ so long as $\delta > 0$.

Baron-Ferejohn Model under Open Rule

- The Baron-Ferejohn model can be extended to allow proposals to be amended before a final passage vote (within a current legislative session).
- (N) Now following each proposal a member is selected at random from the remaining $N - 1$ legislators.



- (N-1) The selected legislator has two choices; she may either *call the question* and bring about a final passage vote on the proposal, or make a new offer or *amendment*.
- The amendment is paired against the current offer.



- The winner of this vote is the proposal on the floor at the beginning of the next session.
- In the next session, a new legislator is chosen either to amend or to call the question.

Baron-Ferejohn Model under Open Rule

Buy two members, so no amendment (grand coalition)

Vs. Buy one member and risk amendment (minimum coalition)

- Now a legislative proposer has two considerations.

1. Just as before, a simple majority must receive their discounted continuation values in order to support the proposal on final passage.
2. Second, the proposer must craft a proposal that deters others from amending it.

- This can be accomplished by allocating sufficient resources that the next proposer prefers to move the initial proposal rather than have her own proposal on the floor at the beginning of the next session.
- To keep matters simple, we focus again on $N = 3$.

Buying Both Legislators

- First, consider a scenario where the proposer keeps z, provides $(1 - z)/2$ to both other legislators, and each legislator moves the question.
- To solve for the optimal z, define $v_i^2(z)$ as the continuation value of beginning a session with a proposal giving z to i and $(1 - z)/2$ to the other two legislators.
- Because we focus on symmetric equ'a, we suppress the subscript i.
- Thus, $v^2(z)$ is the expected utility of this strategy for the first proposer and that of any proposer who successfully amends a proposal.

  ↑ Assuming the 3rd (indifferent) person votes for amend.
- Given this definition, a proposer must give each legislator at least $\delta v^2(z)$ to induce her to call the question.
- Otherwise, a legislator selected in the amendment stage defects, making a proposal giving herself z.

Buying Both Legislators

- Therefore, the equ'm requires $(1 - z)/2 \geq \delta v^2(z)$.
- So long as this condition holds, the proposer gets z with prob. 1 so that $v^2(z) = z$.
- Thus, the proposer maximizes z subject to $(1 - z)/2 \geq \delta v^2(z)$.
- This leads to a solution of

$$v^2(z) = z = \frac{1}{1 + 2\delta}.$$

Buying Only One Legislator

- Although the proposer secures $z = 1/(1+2\delta)$ with certainty, she may prefer to secure the support of only one legislator and risk the defeat of her proposal if the excluded legislator is selected to make an amendment.
- So now assume that the proposer keeps z, gives $1-z$ to some other legislator, and gives 0 to the third legislator.
- The legislator who receives $1-z$ moves the question if selected.
- The legislator who receives 0 offers an amendment giving z to herself, 0 to the original proposer, and $1-z$ to the other legislator.
- Such an amendment carries with the votes of the legislators who receive positive allocation in the amended proposal.

Buying Only One Legislator

- To compute the optimal z, we must consider two values.
- Let $v_i^1(z)$ be the value to legislator i of beginning the period with a proposal giving z to i and $1 - z$ and 0 to the others.
- Similarly, let $v_i^1(0)$ be the value to i of the game starting from a proposal that gives 0 to i and z and $1 - z$ to the others.
- Again b/c of symmetry we drop the subscripts.
- First, we compute $v^1(z)$; with prob. 1/2, the proposal is moved and approved, giving the proposer z.
- With prob. 1/2, however, the proposal is amended so that the original proposer gets 0 in the proposal in play at the beginning of the next session.
- Therefore, $v^1(z) = z/2 + \delta v^1(0)/2$.

Why? Because of stationary equilibrium (& maximum revenge !)

Buying Only One Legislator

- Now consider the value of starting the period with 0.
- With prob. 1/2, the proposal is moved and passed, leading to a payoff of 0.
- With prob. 1/2, the member is selected and amends the proposal so that she gets z in the standing proposal at the beginning of the next session.
- Therefore, $v^1(0) = \delta v^1(z)/2$.
- Putting these two values together, we get

$$v^1(z) = z/2 + \delta^2 v^1(z)/4 \quad \text{or} \quad v^1(z) = \frac{2z}{4 - \delta^2}.$$

Buying Only One Legislator

- Finally, we must ensure that the legislator receiving $1-z$ prefers to move the question rather than amend.
- This requires that $1-z \geq \delta v^1(z)$ or $z \leq 1-\delta v^1(z)$, and the proposer chooses z to maximize $v^1(z)$ subject to this constraint.
- The solution is

$$z = \frac{4-\delta^2}{4+2\delta-\delta^2}$$

leading to a continuation value of

$$v^1(z) = \frac{2}{4+2\delta-\delta^2}.$$

Buying One or Two?

- To determine which strategy the proposer chooses, we simply need to compare $v^1(z)$ and $v^2(z)$.
- Straightforward algebra shows that $v^1(z) > v^2(z)$ when $\delta > \delta^* \equiv \sqrt{3} - 1$.
- Intuitively, when players are patient and value the future, it is very expensive to inhibit amendments from both legislators.
- Therefore, the proposer prefers to buy off only one member and take his chances with an amendment from the other.

Features of the Open Rule

- First, it is possible that coalitions are greater than minimal winning.
  - This occurs when $\delta < \delta^*$ so that the proposer spreads resources sufficiently to deter all amendments.
- Second, there can be equ'm delay in agreement.
  - This occurs when $\delta > \delta^*$ and the proposer gives 0 to one member.
  - If that member is then selected, she makes a successful amendment, which precludes agreement in the first session.

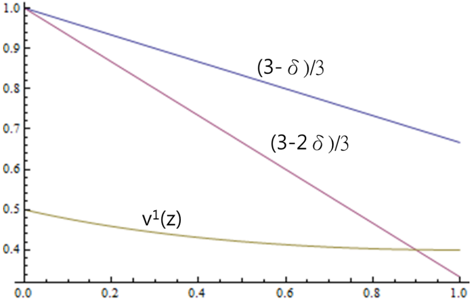
Comparison with the Closed Rule

- The literature often compares open and closed rule in terms of the proposer's share.
- For the closed rule with $N = 3$, the proposer keeps $(3 - \delta)/3$.
- This share is always greater than $v^2(z)$ and is greater than $v^1(z)$ when $\delta > \delta^*$ (in fact, $(3 - \delta)/3 > v^1(z)$ for all $0 < \delta < 1$).
- Thus, the open rule lowers the proposer's advantage. Frechette et al. (APSR 2003) confirmed this comparative statics!
- Proposal power can also be mitigated by the use of supermajority rule.
- Considering the case of $k = N = 3$, the proposer's share (under closed rule) is $(3 - 2\delta)/3$, which is lower than $v^1(z)$ for sufficiently large δ.
- Thus, when $\delta > \delta^*$, the unanimity rule lowers proposal power below that of the open majority rule w/o incurring costly delay.

Comparison with the Closed Rule

1. $(3-\delta)/3 > v^1(z)$ for all $0 < \delta < 1$.
2. $(3-2\delta)/3 < v^1(z)$ for all $0.898768 < \delta < 1$.

* $Plot[\{(3-x)/3, (3-2x)/3, 2/(4+2x-x^2)\}, \{x, 0, 1\}]$ (Mathematica command or www.wolframalpha.com).



Theory Literature

- Rubinstein (ECTA 1982) is a seminal paper for two-person sequential bargaining, and Baron & Ferejohn (APSR 1989) extend the Rubinstein model to majority rule, so initiating the
- While Baron & Ferejohn (1989) focus on bargaining over distribution, Banks & Duggan (APSR 2000) develop a model of bargaining over policy.
- Morelli (APSR 1999) develops an alternative model of "demand bargaining" in which legislators sequentially make demands for joining a coalition; see also Winter (APSR 1996).
- Calvert (1989) develops a theory of legislative reciprocity. In Ordeshook (ed.) *Models of Strategic Choice in Politics*.
- Austen-Smith & Banks (2005) *Positive Political Theory* Vol.II, Chapter 6.

Some Experimental Papers

- Frechette, Kagel & Lehrer (APSR 2003): "Bargaining in Legislatures: An Experimental Investigation of Open versus Closed Amendment Rules."
- Frechette, Kagel & Morelli (ECTA 2005): "Behavioral Identification in Coalitional Bargaining: An Experimental Analysis of Demand Bargaining and Alternating Offers."
- Frechette, Kagel & Morelli (Econ Theory 2012): "Pork versus Public Goods: An Experimental Study of Public Good Provision within a Legislative Bargaining Framework."
- Diermeier & Morton (2005): "Experiments in Majoritarian Bargaining." In Austen-Smith & Duggan (ed.) *Social Choice and Strategic Decisions*.